查询MLX10407供应商

MLX10407

5-Channel Gauge Driver with Serial Link

Features and Benefits

Supply voltage up to 12 V
Interface directly with 5 V CMOS logic MCUs
Serial link
Can drive two 360° actuators & three 90° actuators simultaneously
Open circuit / short-circuit detection of the drivers outputs
Small size (SO24 package)
Real Time Angle Tracking

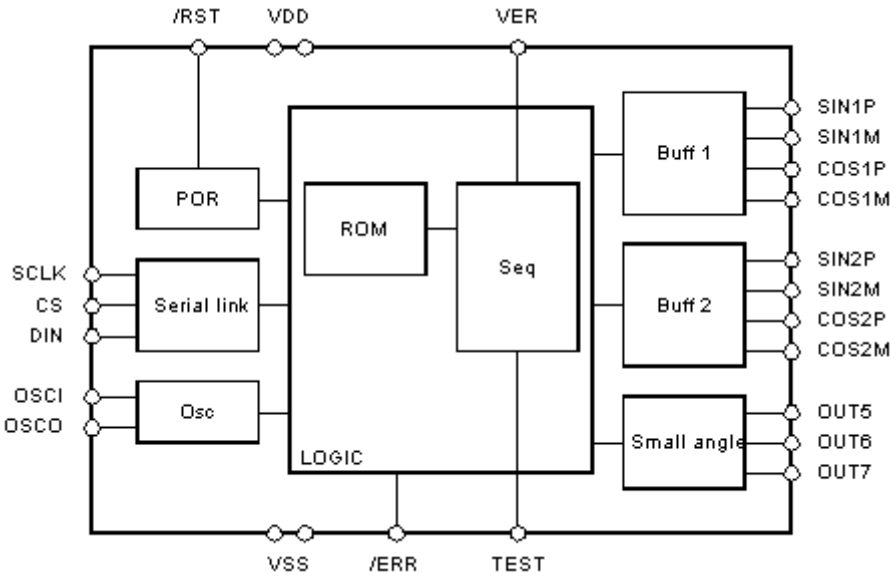
Applications

Logometer Driver Dashboard
Industrial Metering

Ordering Information

Part No.	Temperature Suffix	Package	Temperature Range
MLX11407CA	N/A	SO24	-40C to +85C Automotive

Functional Diagram



Description

The 10407 is a MCU peripheral for logometers control using SIN/COS PWM commands. The circuit controls two independent sets of CMOS power bridges. A ten-bit angle is displayed with a 9 bit per quadrant resolution PWM whose frequency is set by a crystal oscillator. A power-on self test detects open or short-circuit outputs for each logometer and a real time angle tracking avoids display errors.
The 10407 can also drive three small angle logometers (90°). A three wire serial link allows bidirectional communication with the MCU.

DC Electrical Characteristics

Tamb = -40 to 85°C, VDD = 4.5 V to 12 V unless otherwise specified.

Characteristics	Test Conditions	Symbol	Limits			Unit
			Min	Typ	Max	
Supply current	Inputs at VDD or VSS, No loads on outputs	ICC			5.5	mA
Maximum power dissipation		PDmax			620	mW
Inputs						
Input capacitance		Cin			10	pF
Pin 11						
Pull-down resistance		Rpd	125		750	kOhm
Input voltage LOW		VIL	-0.3		1	V
Input voltage HIGH		VIH	4		VDD+0.3	V
Hysteresis	VDD = 8.5 V	VHYS	0.5		2.5	V
Leakage current	pin at VDD or VSS	IL	-1		1	µA
Pin 12, 13, 14, 15, 17						
Input voltage LOW		VIL	-0.3		1	V
Input voltage HIGH		VIH	4		VDD+0.3	V
Hysteresis	VDD = 8.5 V	VHYS	0.5		2.5	V
Leakage current (pin 12, 15, 17)	pin at VDD or VSS	IL	-1		1	µA
Pull-down resistance (pin 14)		Rpd	0.8		1.5	kOhm
Outputs						
Pin 16						
Low level output voltage	IOUT < 500 µA	VOL			0.3	V
High level output leakage current	VOUT=VDD	ILKG			10	µA
Pin 2, 3, 5, 6, 20, 21, 23, 24						
Drop-out voltage for each pair of buffers	VDD = 8.5V, Tamb = 25°C, Icoil = 30 mA	Vd			1.6	V
Mismatch of drop-out voltage		D Vd			± 50	mV
Pin 7, 8, 9						
Output voltage low	VDD = 8.5V, Tamb= 25°C, Isink = 40mA	VOL		0.3	0.6	V
Output voltage high	VDD = 8.5V, Tamb= 25°C, Isource = 40mA	VOH	6.8	7.8		V
Oscillator						
Pin 18,19						
Input pin capacitance		Cin		10	20	pF

ABSOLUTE MAXIMUM RATINGS

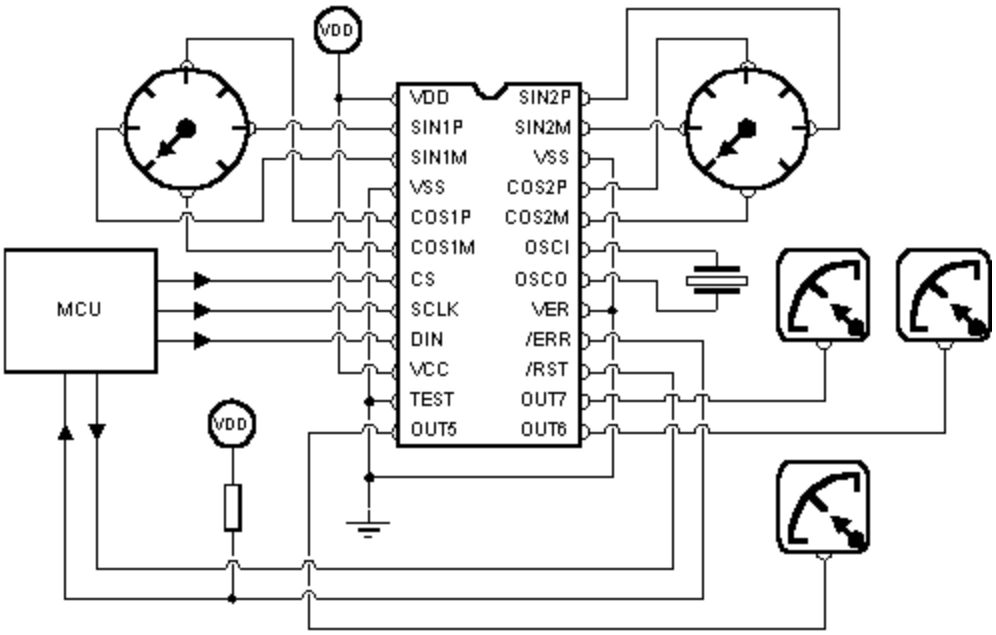
Parameter	Symbol	Value		Unit
		Min	Max	
Storage Temperature Range	Tstg	-40	+150	°C
Operating Temperature Range	Tamb	-40	+85	°C
Supply Voltage Range	VDD	-0.3	14.0	V
Input Voltage Range	Vi	-0.3	VDD +0.3	V

AC Electrical Characteristics

Tamb = -40 to 85°C, VDD = 4.5 V to 12 V unless otherwise specified.

Characteristics	Test Conditions	Symbol	Limits			Unit
			Min	Typ	Max	
Oscillator			0.95		8.4	MHz
Clock frequency		Fclk		8		MHz
Serial communication						
Serial data clock frequency		Fsclk		500		kHz
Time for DIN stable to SCLK rise				100		ns
Hold time for DIN			100			ns

Typical application



Notes

- The chip integrates its oscillator load capacitors.
- The quartz frequency is 8MHz

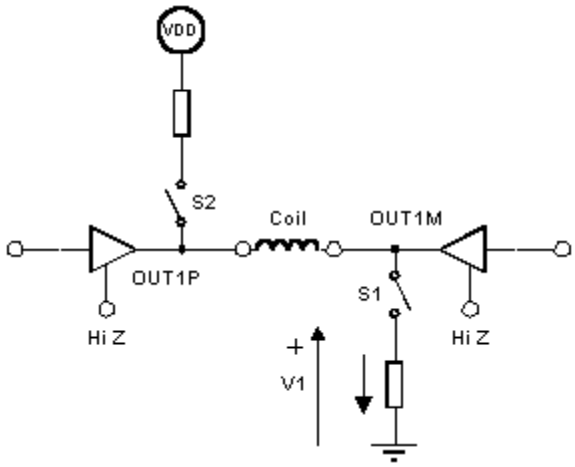
Operation

1) 360° logometers

Immediately following a reset, the IC checks if there is any short-circuit or open circuit on each buffer driver output (This test is not performed for outputs 5, 6 and 7). During this test, each buffer is held in a high impedance state and large value internal resistors (100kOhm) are sequentially connected on each pair of buffers (note : actuator coils must be connected on bridges).

Three tests are performed according to the following figure and table.

Test for short and open circuits



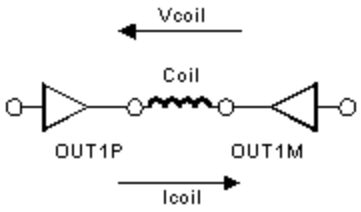
	Conditions	Test for :
Test 1	S1 closed, S2 open	V1 = VSS
Test 2	S1 open, S2 closed	V1 = VDD
Test 3	S1 and S2 closed	V1 = VDD/2

During the tests the pin ERRB (16) is at logic level 0. After completing the tests, ERRB remains low if one (or more) test failed.
ERRB returns to high impedance if everything is OK.

These tests last approximately 4 ms with an oscillator clock frequency of 8 MHz.

After testing, all buffers are at VSS. The chip then waits for the MCU to send an angle/quadrant value to output the PWM signals for each buffer. Every logometer coil is connected in a bridge, so the current Icoil can be either positive or negative.

The total drop-out of a bridge is : $V_d = | V_{CC} - V_{coil} |$



One Bridge

2) 90° logometers

In addition to driving (2) 360° logometers the MLX10407 has a push-pull stage so it Is possible to drive (3) additional 90° coils connected to GND or VDD respectively.

Serial Link

The MCU outputs the serial communication clock SCLK, the chip select CS, the data DIP, and reads the ERRB error status.

The data sent by the MCU is latched by the 10407 on the rising edge of SCLK.
The 10407 outputs the ERRB signal on the falling edge of SCLK

When CS = "0" the serial interface of the 10407 is inactive. When CS goes HIGH, the 10407 waits for a START BIT and then reads the following 15 bits transmitted by the MCU.

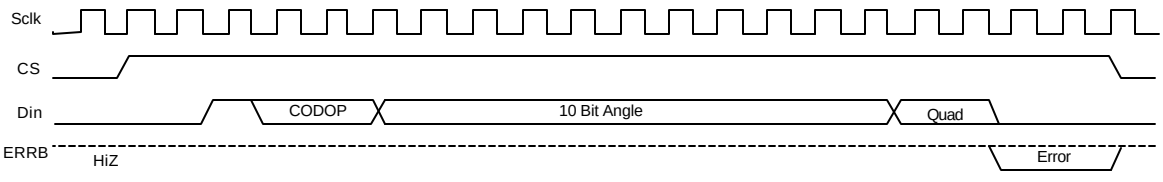
The START BIT (D0) must be "1".

D1	D2	D3	Instruction
0	0	0	Unused
0	0	1	Writing request LOGO1
0	1	0	Unused
0	1	1	Writing request LOGO2
1	0	0	Writing request LOGO3
1	0	1	Writing request LOGO5
1	1	0	Writing request LOGO4
1	1	1	Unused

The following 10 bits (D4, D5, D6, D7, D8, D9, D10, D11, D12, D13) set the angle value (D13 =lsb, D4 = msb).

The two remaining bits (D14D15) represent the quadrant (D14=msb). Note: for Logo1 & 2 only.

Serial Link



MLX10407 Serial link Protocol

The 10407 outputs an error status on pin ERRB on the falling edge of SCLK immediately following the transmission of the quadrant lsb.

The pin 16 (ERRB) of the 10407 is driven low if there is no continuity between two consecutive quadrant values sent (for logo1 or logo2). The data is valid till CS is high, then when CS goes low ERRB returns to high impedance state and the error status is lost.

If the MCU has detected an error, it is possible to send data again : the first data bit set to "1" will initiate a new transmission of 15 data bits.

On the HIGH to LOW transition of CS the angle and quadrant values are stored into the internal registers of the 10407 if the following conditions are met:

- The MCU sent the appropriate writing request
- No quadrant error was detected by the 10407.

Otherwise new angle and quadrant values are discarded by the 10407 and the previous values are kept. The MCU will have to initialize a new transmission to the 10407.

If VER (pin 17) is connected to VDD then the 10407 does *not* store values of angles and quadrant in case of an error. It is however possible to make the 10407 store all angles and quadrant values even if there is an error, by connecting VER (pin 17) to GND.

PWM Generation

1) Logometers 360° (Logo 1 and Logo 2):

From the angle value received from the MCU (range [0° - 89.8°]), the 10407 generates two PWM signals (9 bit resolution) :

- The first one represents the sine PWMSIN,
- The second one is the cosine PWMCOS.

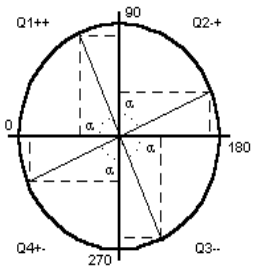
The 10407 uses a 512x9 ROM containing the sine of all angular values in the range [0° -89.8°] (note that the lsb value of the angle is not used).

An angle value greater than 90° is obtained using different quadrant values :

- Q1 (D14D15 = 00) > 0° =< a < 90°
- Q2 (D14D15 = 01) > 90° =< a < 180°
- Q3 (D14D15 = 10) > 180° =< a < 270°
- Q4 (D14D15 = 11) > 270° =< a < 360°

a is the angle value

The PWM are switched to the outputs depending on the value of the quadrant :



QUADRANT	SIN1M	SIN1P	COS1M	COS1P	
D14	D15				
0	0	0	PWMSIN	0	PWMCOS
0	1	0	PWMCOS	PWMSIN	0
1	0	PWMSIN	0	PWMCOS	0
1	1	PWMCOS	0	0	PWMSIN

- Logometer 1 is driven by outputs SIN1M/P COS1M/P,
- Logometer 2 is driven by outputs SIN2M/P COS2M/P.

The PWM frequency is given by :

$F_{PWM} = F_{OSC} / 512$ (F_{OSC} = Crystal oscillator frequency)

2) Logometers 90°

- There are three separate PWM outputs for Logo 3, Logo 4 and Logo 5.

Pin Out

Pin	Symbol	Description
1	VDD	
2	SIN1P	Output buffer (coil 1 Logo1)
3	SIN1M	Output buffer (coil 1 Logo1)
4	VSS	
5	COS1P	Output buffer (coil 2 Logo1)
6	COS1M	Output buffer (coil 2 Logo1)
7	OUT5	Output buffer (Logo 3)
8	OUT6	Output buffer (Logo 4)
9	OUT7	Output buffer (Logo 5)
10	VDD	
11	CS	Chip select (Schmitt trigger with 300kOhm pull-down)
12	SCLK	Serial clock (Schmitt trigger)
13	DIN	Data IN (Schmitt trigger)
14	TEST	TEST input.(1K pull-down)
15	RSTB	External reset (Schmitt trigger)
16	ERRB	Quadrant error output (Open drain)
17	VER	Quadrant verification inhibit
18	OSCO	Crystal oscillator output
19	OSCI	Crystal oscillator input
20	COS2M	Output buffer (coil 2 Logo2)
21	COS2P	Output buffer (coil 2 Logo2)
22	VSS	
23	SIN2M	Output buffer (coil 1 Logo2)
24	SIN2P	Output buffer (coil 1 Logo2)

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